

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-324713

(43)Date of publication of application : 22.11.2001

(51)Int.Cl.

G02F 1/1335  
G02B 5/08  
G02B 5/20  
G09F 9/30

(21)Application number : 2000-141420

(71)Applicant : HITACHI LTD  
HITACHI DEVICE ENG CO LTD

(22)Date of filing : 15.05.2000

(72)Inventor : NEMOTO SOTA  
YOSHIDA KAZUTOSHI  
UEHARA MASAO  
HOSHINO NOBORU  
NAKAMURA YOSHIAKI  
FUJIEDA MASAYOSHI  
HIRAGA KOJI

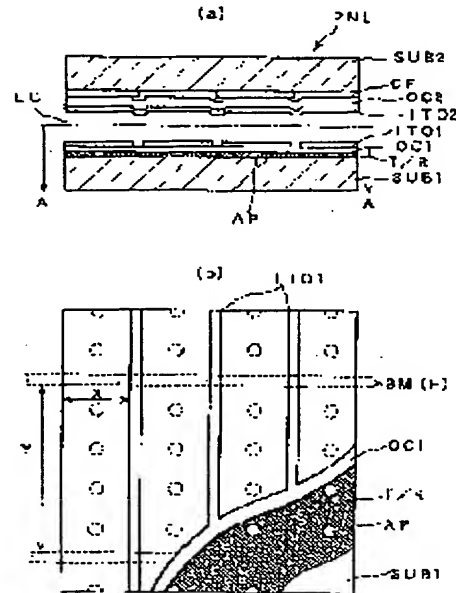
(54) LIQUID CRYSTAL DISPLAY ELEMENT AND LIQUID CRYSTAL DISPLAY DEVICE USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a bright picture display with excellent contrast optionally by a transmissive display mode or by a reflective display mode and to permit an excellent color display by either of the display modes.

SOLUTION: A liquid crystal LC is held between a first transparent substrate SUB1 having a plurality of electrodes of one side ITO1 and a second transparent substrate SUB2 having a plurality of electrodes of the other side ITO2 placed opposite to the electrodes of the one side. Pixel regions are formed on the respective mutually confronting parts of the electrodes of the one side ITO1 and the electrodes of the other side ITO2. A semitransmissive reflective film T/R is arranged between the first transparent substrate SUB1 and the electrodes of the one side ITO1. Light transmission holes AP are formed on the pixel regions of the semitransmissive reflective film T/R or slits SLT are formed between neighboring pixel regions and a part of illuminating light incident from the side of the first transparent substrate SUB1 is made incident on the liquid crystal LC.

図 1



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than  
the examiner's decision of rejection or  
application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision  
of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] Liquid crystal is pinched between the 1st transparence substrate which has two or more one electrodes, and the 2nd transparence substrate which has two or more one [ said ] electrodes and electrodes of another side which countered. The liquid crystal display component characterized by providing transfective and the reflective film which is the liquid crystal display component which formed the pixel field in each opposite section of one [ said ] electrode and the electrode of another side, and has 1 or two or more light transmission holes to said pixel field between said 1st transparence substrate and one [ said ] electrodes.

[Claim 2] The liquid crystal display component according to claim 1 which is equipped with the light filter layer which superimposed the contiguity edge between said 2nd transparence substrate and electrodes of said another side, and is characterized by forming a light-shielding film between contiguity pixels by said superimposed contiguity edge.

[Claim 3] Liquid crystal is pinched between the 1st transparence substrate which has two or more one electrodes, and the 2nd transparence substrate which has two or more one [ said ] electrodes and electrodes of another side which countered. While being the liquid crystal display component which formed the pixel field in each opposite section of one [ said ] electrode and the electrode of another side and having 1 or two or more light transmission holes to said pixel field between said 1st transparence substrate and one [ said ] electrodes The liquid crystal display component characterized by providing transfective and the reflective film which has a slit along with the edge of said pixel field.

[Claim 4] The liquid crystal display component according to claim 3 characterized by providing the optical absorption film formed in the lower layer by the side of the 1st [ of said slit / said ] transparence substrate.

[Claim 5] The liquid crystal display component according to claim 3 characterized by filling up said slit with the optical absorption film.

[Claim 6] The liquid crystal display according to claim 1 to 5 characterized by having arranged the source of the illumination light at the tooth back of said 1st transparence substrate of said liquid crystal display component.

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the liquid crystal display using the liquid crystal display component and this liquid crystal display component of the transfective and the reflective mold which is applied to a liquid crystal display component, especially displays an image as selectively available in the transmitted light and the reflected light.

[0002]

[Description of the Prior Art] Since it is a light weight and a low power in a thin shape, the so-called liquid crystal display which constituted the imaging means from a liquid crystal display component is used as a display of wide range electronic equipment, such as a notebook sized personal computer, a word processor, an electronic notebook, a portable telephone, and a camera one apparatus videocassette recorder.

[0003] Unlike the Braun tube or a PUREZUMA display unit, itself does not emit light, but a liquid crystal display component controls the quantity of light of the light which carried out incidence from the outside, and displays an image etc. The color picture display multicolor by making the light filter of two or more colors provide as an optical controlling element of a liquid crystal display component is attained.

[0004] The liquid crystal display present most generally used is the so-called transparency type which installed the source of the illumination light called the back light which used fluorescence tubing etc. in the tooth back of a liquid crystal display component, and was considered as the configuration which controls the amount in which the light in which a back light emits light penetrates a liquid crystal display component, and displays an image of liquid crystal display.

[0005] However, in this transparency type of liquid crystal display, when the electronic equipment of the pocket mold which the power consumption by the back light occupied the abbreviation one half of total power consumption, and described above is cell actuation, it is the big factor which shortens that time. Moreover, when using it on the bright outdoors etc., outdoor daylight reflects the liquid crystal display of a transparency mold on the surface of a viewing area, and for this reason, discernment of a display image becomes remarkably difficult.

[0006] There is the so-called reflective type which usually possesses a reflecting plate as what is used in bright environments, such as the outdoors, always carrying, without using a back light, and controls the reflected light of the outdoor daylight from a perimeter by the liquid crystal layer of liquid crystal display component. What was made to perform a transparency mold display and a reflective mold display is known by such liquid crystal display component using transfective and reflective film which is indicated by JP,7-333598,A.

[0007] Moreover, as other examples of this kind of liquid crystal display component, there are some which constituted one pixel electrode from two fields, a reflective field and a transparency field, as indicated by JP,7-333598,A.

[0008]

[Problem(s) to be Solved by the Invention] However, with the liquid crystal display component of the above-mentioned conventional technique, it becomes that from which the display quality differed by operating environment (light source environment) change. That is, contrast ratios

differ in the display at the time of using the case (reflected light mode) where the reflected light is used, and the transmitted light (transmitted light mode), and in monochrome display, a coloring phenomenon arises or a gap occurs to the color tone in color specification. A gap of a contrast ratio is because the reflected light differs from the transmitted light in black display brightness, i.e., off permeability and white display brightness, i.e., ON permeability, and degrades the visibility of a display image. Moreover, especially a gap of a color tone is a phenomenon which the color tone in the transmitted light shifts blue, and will degrade color repeatability.

[0009] The object of this invention is to cancel the technical problem of the above-mentioned conventional technique, and obtain image display by the good contrast ratio with any display mode of a transparency mold and a reflective mold, and offer the liquid crystal display component in which good color display is possible with any display mode.

[0010]

[Means for Solving the Problem] The 1st transparence substrate with which this invention has two or more one electrodes in order to cancel the above-mentioned technical problem, Liquid crystal is pinched between the 2nd transparence substrate which has two or more one [ said ] electrodes and electrodes of another side which countered. Form a pixel field in each opposite section of one [ said ] electrode and the electrode of another side, and transfective and the reflective film are arranged between said 1st transparence substrate and one [ said ] electrodes. The light transmission hole was formed in the pixel field of this transfective and reflective film, or a slit is formed between adjoining pixel fields and it was made to carry out incidence of a part of illumination light which carries out incidence from a 1st transparence substrate side to liquid crystal.

[0011] In order for a part of illumination light which carries out incidence to carry out outgoing radiation to a 2nd transparence substrate side through a light filter by having considered as this configuration from the outside of the 1st transparence substrate in transmitted light mode, while the visibility of a display image improves, the color tone gap in the transmitted light decreases, and color repeatability improves.

[0012] The contrast in transmitted light mode improves by forming transfective and the reflective film also between adjoining pixel fields.

[0013] Moreover, the contiguity edge of the light filter layer formed between the transparence substrate of the above 2nd and the electrode of said another side was superimposed, and the protection-from-light function was given. By piling up the adjoining light filter layer, the function as a protection-from-light layer is given to this superposition part, and contrast improves.

[0014] Furthermore, the optical absorption film has been arranged in the lower layer of the slit formed in the transparence substrate side of the above 1st, or the above-mentioned slit was filled up with the optical absorption film. Thereby, the color mixture between contiguity pixels is controlled and contrast improves.

[0015] And the source of the illumination light has been arranged at the tooth back of said 1st transparence substrate of said liquid crystal display component, and the liquid crystal display of transfective and a reflective mold was constituted. In sufficient environment, surrounding brightness turns off the source of the illumination light, uses it in reflected light mode, and uses it in transmitted light mode by setting this to ON in a dark environment. Color repeatability improves in any mode.

[0016] The liquid crystal display of the transfective and the reflective mold using the above-mentioned liquid crystal display component carried out the laminating of a top polarizing plate and the bottom polarizing plate to the field of the opposite hand (1st transparence substrate side), respectively the display screen side (2nd transparence substrate side) of a liquid crystal display component, and made those absorption shafts (polarization shaft) intersect perpendicularly mostly.

[0017] It has the 1st orientation film in the inner surface of the incidence side substrate (1st transparence substrate) of the illumination light in transmitted light mode, and the orientation shaft of this 1st orientation film and the absorption shaft of a bottom polarizing plate are arranged so that it may be parallel mostly. When the electrical potential difference used as a black display was impressed to the pixel electrode of a liquid crystal display component, black

display brightness (off permeability) was made low, when the electrical potential difference used as a white display was impressed, white display brightness (ON permeability) was made high, and the contrast ratio of a display image was enlarged irrespective of the display mode.

[0018] Moreover, the laminating of the 1st high order phase differential plate and the 2nd high order phase differential plate is carried out to the substrate by the side of the display screen of a liquid crystal display component, and the light which shifted about 30 degrees (30 degrees \*\*20 degrees) of those drawing shafts of each other, and passed the liquid crystal layer is mostly changed into the linearly polarized light. Color reproduction in the high quality which prevents a gap of the foreground-color tone in the coloring phenomenon and color display in monochrome display (neutral-izing of a foreground color), and does not have a color tone gap by this was made possible.

[0019] It will be as follows if the typical configuration of this invention is described. Namely, liquid crystal is pinched between the 1st transparence substrate which has two or more (1) one electrodes, and the 2nd transparence substrate which has two or more electrodes of the method of up Norikazu, and electrodes of another side which countered. The pixel field was formed in each opposite section of the electrode of the method of up Norikazu, and the electrode of another side, and transfective and the reflective film which has 1 or two or more light transmission holes to the above-mentioned pixel field between the transparence substrate of the above 1st and one [ said ] electrode were provided.

(2) Between the transparence substrate of the above 2nd, and the electrode of above-mentioned another side, it had the light filter layer which superimposed the contiguity edge, and the light-shielding film was formed between contiguity pixels by the superimposed above-mentioned contiguity edge.

(3) Pinch liquid crystal between the 1st transparence substrate which has two or more one electrodes, and the 2nd transparence substrate which has two or more electrodes of the method of up Norikazu, and electrodes of another side which countered. While forming the pixel field in each opposite section of the electrode of the method of up Norikazu, and the electrode of another side and having 1 or two or more light transmission holes to the above-mentioned pixel field between the transparence substrate of the above 1st, and the electrode of the method of up Norikazu, transfective and the reflective film which has a slit along with the edge of the above-mentioned pixel field were provided.

(4) The optical absorption film was formed in the lower layer by the side of the transparence substrate of the above 1st of the above-mentioned slit, or the above-mentioned slit was filled up with the optical absorption film.

(5) The above (1) to each field by the side of the transparence substrate of the above 1st the transparence substrate side of the above 2nd of the liquid crystal display component of - (4) The laminating of the polarizing plate after making those absorption shafts (polarization shaft) intersect perpendicularly mostly, and the bottom polarizing plate is carried out, respectively. An interface with the liquid crystal of each inner surface of the transparence substrate of the above 1st and the transparence substrate of the above 2nd is equipped with the 1st orientation film and the 2nd orientation film, respectively. The orientation shaft of the orientation film of the above 1st and the absorption shaft of the bottom polarizing plate of the above are arranged so that it may be parallel mostly. The laminating of the 1st high order phase differential plate and the 2nd high order phase differential plate which shifted about 30 degrees (30 degrees \*\*20 degrees) of drawing shafts of each other on the outside surface of the transparence substrate of the above 2nd was carried out, the source of the illumination light has been arranged at the tooth back of the transparence substrate of the above 1st, and the liquid crystal display of transfective and a reflective mold was constituted.

[0020] When the electrical potential difference which black display brightness (off permeability) becomes low when the electrical potential difference of a liquid crystal display component which reaches on the other hand and serves as a black display at the pixel electrode of another side is impressed, and serves as a white display by this configuration is impressed, white display brightness (ON permeability) becomes high, and the contrast ratio of a display image becomes large irrespective of a display mode. Therefore, visibility improves and the liquid crystal display

component of high quality can be realized.

[0021] Moreover, it had the diffusion layer between the high order phase differential plate of the above 1st, and the 2nd high order phase differential plate. Although this diffusion layer may use a known diffusion sheet, if what mixed the optical diffusion particle in the binder for sticking the 1st high order phase differential plate and the 2nd high order phase differential plate is used, optical loss can be acquired for a display bright as min.

[0022] The color picture display of the high quality which does not have a bright image or a bright color tone gap with it by each above-mentioned configuration in any of the environment which has bright outdoor daylight, using the transmitted light and the reflected light selectively, and a dark environment is obtained. [ a high contrast ratio and ] [ clear ]

[0023] In addition, it cannot be overemphasized that various deformation is possible, without not restricting this invention to each above-mentioned configuration and the configuration of an example mentioned later, and deviating from the technical thought of this invention.

[0024]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the liquid crystal display component by this invention is explained to a detail with reference to the drawing of an example.

[0025] Drawing 1 is a mimetic diagram explaining the configuration of the 1st example of the liquid crystal display component by this invention, and drawing 1 (a) shows the important section top view of the 1st transparence substrate with which drawing 1 (b) saw the important section cross section from [ of \*\* (a) ] arrow-head A-A. In addition, in drawing 1, the orientation film which regulates the direction of initial orientation of liquid crystal, a polarizing plate, a phase contrast plate, etc. omitted the graphic display.

[0026] This liquid crystal display component PNL is a passive-matrix mold (STN-LCD), and is pinching the liquid crystal layer (or it is only called liquid crystal) LC between the 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2.

[0027] The 1st transparence substrate SUB 1 is a hard plate, and used the glass plate here. Transflective and reflective film T/R are formed in the inner surface of the 1st transparence substrate SUB 1, and two or more electrodes (transparence pixel electrode) ITO1 of one [ which constitutes a pixel through the overcoat layer OC 1 ] are parallel, and are formed. Although ITO (indium Ching oxide: oxidization in JUMU) and IZO (indium zinc oxide: zinc oxide) were used as one electrode ITO1, ITO was adopted here. The graphic display is omitted although the bottom orientation film with which the electrode ITO1 of one of these was covered, and orientation processing was performed by rubbing etc. is formed.

[0028] Moreover, the 2nd transparence substrate SUB 2 is a glass plate, and it has the light filter CF of three colors (for example, R, G, B) in the location which countered the inner surface with one [ said ] electrode ITO1. The each adjoining light filter CF has given the protection-from-light function (function as a black matrix (length BM) of a lengthwise direction) by piling up mutually. This superposition width of face is made into the width of face and abbreviation same width of face between one electrodes ITO1.

[0029] A light filter CF is covered, the overcoat layer OC 2 is formed, and it has the electrode ITO2 of another side in the upper layer (liquid crystal LC side). The electrode ITO2 of this another side is also formed with the same electrical conducting material as the electrode ITO1 of the method of up Norikazu.

[0030] A transparent electrode ITO1 is made to intersect, it is arranged, and a unit pixel is formed in an intersection for while the electrode ITO2 of another side was formed in the 1st transparence substrate SUB 1.

[0031] BM (H) in drawing 1 (b) is the longitudinal direction light-shielding film (width BM) formed so that the electrode ITO2 of the another side concerned might be crossed to the 2nd transparence substrate SUB 2 side, and the field of the above-mentioned length BM and the (Width X) x length (Y) surrounded by this side BM is a pixel field (unit pixel) of one classification by color corresponding to one light filter.

[0032] Transflective and reflective film T/R formed in the 1st transparence substrate SUB 1 come on the 1st transparence substrate SUB 1 concerned by \*\*\*\*\* TA formation of the metal

membrane of aluminum alloy or Ag alloy, and has formed the light transmission hole AP in the 1-pixel field of (Width X) x length (Y). In this example, although the number of the light transmission holes AP is made into four round holes to each pixel field, the number and a configuration are arbitrary so that it may mention later.

[0033] In addition, the liquid crystal ingredient which constitutes the liquid crystal LC pinched between the 1st and 2nd transparence substrate SUB1 and SUB2 is STN (super twisted nematic) liquid crystal.

[0034] The light filter formed in the 2nd transparence substrate SUB 2 was formed according to the photolithography process which used the pigment-content powder type resist. However, it can form by the thing using the approach and ink jet which use a color for a stain and color it, the method of sticking the color sheet which printed three colors beforehand, and other known approaches.

[0035] The overcoat layers OC1 and OC2 aim at construction material protection of the liquid crystal ingredient which constitutes transfective and reflective film T/R, a light filter CF, and liquid crystal LC, reservation of the uniform liquid crystal orientation by surface flattening, etc. As an ingredient of this overcoat layer OC 1 (OC2), heat-curing mold acrylic resin, urethane resin, polyglycidylmethacrylate system resin, silica system inorganic material, etc. can be used.

[0036] As mentioned above, according to this example, the brightness in transmitted light mode improves by forming the light transmission hole AP in transfective and reflective film T/R. Moreover, dispersion in the case of forming transfective and reflective film T/R by FOTORISO etching can be minimized by having made the light transmission hole AP into the round hole configuration, and equalization of the opening area of the light transmission hole AP concerned is easy.

[0037] Furthermore, while constitutes each pixel electrode, and by having formed transfective and reflective film T/R in the part between electrodes ITO1 (the gap of an adjoining pixel field: slit), when the back light installed in the tooth back of a liquid crystal display component is turned on, the optical leakage from between concerned one electrodes ITO1 can be intercepted, and the contrast in transmitted light mode can be raised.

[0038] Drawing 2 is a mimetic diagram explaining the configuration of the 2nd example of the liquid crystal display component by this invention, and drawing 2 (a) shows the important section top view of the 1st transparence substrate with which drawing 2 (b) saw the important section cross section from [ of \*\* (a) ] arrow-head B-B. In addition, in drawing 2, the orientation film which regulates the direction of initial orientation of liquid crystal, a polarizing plate, a phase contrast plate, etc. omitted the graphic display.

[0039] This liquid crystal display component PNL is the same passive-matrix mold (STN-LCD) as the 1st example, and is pinching liquid crystal LC between the 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2.

[0040] The 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2 used the same glass plate as the 1st example both. Transfective and reflective film T/R are formed in the inner surface of the 1st transparence substrate SUB 1, and two or more electrodes ITO1 of one [ which constitutes a pixel through the overcoat layer OC 1 ] are parallel, and are formed. One electrode ITO1 used ITO like the 1st example. The graphic display is omitted although the bottom orientation film with which the electrode ITO1 of one of these was covered, and orientation processing was performed by rubbing etc. is formed.

[0041] Moreover, it has the light filter CF of three colors (for example, R, G, B) in the location which countered the inner surface of the 2nd transparence substrate SUB 2 with one [ said ] electrode ITO1. The each adjoining light filter CF has given the protection-from-light function (function as a black matrix (length BM) of a lengthwise direction) by piling up mutually. This superposition width of face is made into the width of face and abbreviation same width of face between one electrodes ITO1.

[0042] A light filter CF is covered, the overcoat layer OC 2 is formed, and it has the electrode ITO2 of another side in the upper layer (liquid crystal LC side). The electrode ITO2 of this another side is also formed with the same electrical conducting material as the electrode ITO1 of the method of up Norikazu.

[0043] A transparent electrode ITO1 is made to intersect, it is arranged, and a unit pixel is formed in an intersection for while the electrode ITO2 of another side was formed in the 1st transparence substrate SUB 1.

[0044] BM (H) in drawing 2 (b) is the longitudinal direction light-shielding film (width BM) formed so that the electrode ITO2 of the another side concerned might be crossed to the 2nd transparence substrate SUB 2 side, and the field of the above-mentioned length BM and the (Width X) x length (Y) surrounded by this side BM is a pixel field (unit pixel) of one classification by color corresponding to one light filter.

[0045] Slit SLT is formed between electrodes ITO1, and while transfective and reflective film T/R formed in the 1st transparence substrate SUB 1 become by formation of the ingredient same on the 1st transparence substrate SUB 1 concerned as the 1st example and adjoining is separated by the response between pixel fields.

[0046] And the light transmission hole AP is formed in the 1-pixel field of the (Width X) x length (Y) of this transfective and reflective film T/R. Although the number of the light transmission holes AP also makes this example four round holes to each pixel field, the number and a configuration are arbitrary so that it may mention later.

[0047] In addition, the liquid crystal ingredient which constitutes the liquid crystal LC pinched between the 1st and 2nd transparence substrate SUB1 and SUB2 is STN (super twisted nematic) liquid crystal.

[0048] The light filter formed in the 2nd transparence substrate SUB 2 was formed according to the photolithography process which used the pigment-content powder type resist. However, it can form like the 1st example by the thing using the approach and ink jet which use a color for a stain and color it, the method of sticking the color sheet which printed three colors beforehand, and other known approaches.

[0049] The overcoat layers OC1 and OC2 aim at construction material protection of the liquid crystal ingredient which constitutes transfective and reflective film T/R, a light filter CF, and liquid crystal LC, reservation of the uniform liquid crystal orientation by surface flattening, etc. As an ingredient of this overcoat layer OC 1 (OC2), heat-curing mold acrylic resin, urethane resin, polyglycidylmethacrylate system resin, silica system inorganic material, etc. can be used.

[0050] As mentioned above, according to this example, the brightness in transmitted light mode improves by forming the light transmission hole AP in transfective and reflective film T/R. Moreover, dispersion in the case of forming transfective and reflective film T/R by FOTORISO etching can be minimized by having made the light transmission hole AP into the round hole configuration, and equalization of the opening area of the light transmission hole AP concerned is easy.

[0051] Furthermore, while constitutes each pixel electrode, and by having formed Slit SLT in transfective and reflective film T/R of a part between electrodes ITO1 (the gap of an adjoining pixel field: slit), when the back light installed in the tooth back of a liquid crystal display component is turned on, a part of back light light can be introduced into liquid crystal LC, and the brightness in transmitted light mode can be raised.

[0052] Drawing 3 is a mimetic diagram explaining the configuration of the 3rd example of the liquid crystal display component by this invention, and drawing 3 (a) shows the important section top view of the 1st transparence substrate with which drawing 3 (b) saw the important section cross section from [ of \*\* (a) ] arrow-head C-C. In addition, in drawing 3, the orientation film which regulates the direction of initial orientation of liquid crystal, a polarizing plate, a phase contrast plate, etc. omitted the graphic display.

[0053] This liquid crystal display component PNL is the same passive-matrix mold (STN-LCD) as the 1st and 2nd example, and is pinching liquid crystal LC between the 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2.

[0054] The 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2 both used the same glass plate as the 1st and 2nd example. Transfective and reflective film T/R are formed in the inner surface of the 1st transparence substrate SUB 1, and two or more electrodes ITO1 of one [ which constitutes a pixel through the overcoat layer OC 1 ] are parallel, and are formed. One electrode ITO1 used ITO like the 1st and 2nd example. The graphic display

is omitted although the bottom orientation film with which the electrode ITO1 of one of these was covered, and orientation processing was performed by rubbing etc. is formed.

[0055] Moreover, it has the light filter CF of three colors (for example, R, G, B) in the location which countered the inner surface of the 2nd transparence substrate SUB 2 with one [ said ] electrode ITO1.

[0056] A light filter CF is covered, the overcoat layer OC 2 is formed, and it has the electrode ITO2 of another side in the upper layer (liquid crystal LC side). The electrode ITO2 of this another side is also formed with the same electrical conducting material as the electrode ITO1 of the method of up Norikazu.

[0057] A transparent electrode ITO1 is made to intersect, it is arranged, and a unit pixel is formed in an intersection for while the electrode ITO2 of another side was formed in the 1st transparence substrate SUB 1.

[0058] The field of the (Width X) x length (Y) which the light-shielding film (black matrix BM) which becomes the 1st transparence substrate SUB 1 from Width BM (BM (H)) and Length BM (BM (V)) was formed, and was surrounded in the above-mentioned width BM (BM (H)) and this length BM (BM (V)) is a pixel field (unit pixel) of one classification by color corresponding to one light filter.

[0059] Transflective and reflective film T/R are formed in the upper layer of the light-shielding film formed in the 1st transparence substrate SUB 1. Slit SLT was formed between electrodes ITO1, the light-shielding film was made to expose to this slit SLT, and while this transflective and reflective film T/R become by formation of the same ingredient as the 1st and 2nd example and adjoining has separated the pixel field by this light-shielding film. A light-shielding film BM applies the protection-from-light ingredient which mixed the photosensitive resist, and can form it using a known photolithography technique exposed through the photo mask which has a predetermined opening pattern. Moreover, a light-shielding film BM can also be formed with screen printing.

[0060] The effective width of face (optical width of face) of the above-mentioned light-shielding film BM is decided by this example with the process tolerance of the slit SLT formed in subsequent transflective and reflective film T/R. Therefore, the formation width of face of a light-shielding film should form [ while ] in the upper layer of the overcoat layer OC 1 and be just wider than the interproximal space between electrodes ITO1. Therefore, the formation precision of a light-shielding film BM does not need to be high, and the above-mentioned print processes are also as enough as it as \*\*.

[0061] And the light transmission hole AP is formed in the 1-pixel field of the (Width X) x length (Y) of this transflective and reflective film T/R. Although the number of the light transmission holes AP also makes this example four round holes to each pixel field, the number and a configuration are arbitrary so that it may mention later.

[0062] In addition, the liquid crystal ingredient which constitutes the liquid crystal LC pinched between the 1st and 2nd transparence substrate SUB1 and SUB2 is STN (super twisted nematic) liquid crystal.

[0063] The light filter formed in the 2nd transparence substrate SUB 2 was formed according to the photolithography process which used the pigment-content powder type resist. However, it can form like the 1st example by the thing using the approach and ink jet which use a color for a stain and color it, the method of sticking the color sheet which printed three colors beforehand, and other known approaches.

[0064] The overcoat layers OC1 and OC2 aim at construction material protection of the liquid crystal ingredient which constitutes transflective and reflective film T/R, a light-shielding film BM, a light filter CF, and liquid crystal LC, reservation of the uniform liquid crystal orientation by surface flattening, etc. As an ingredient of this overcoat layer OC 1 (OC2), heat-curing mold acrylic resin, urethane resin, polyglycidylmethacrylate system resin, silica system inorganic material, etc. can be used.

[0065] As mentioned above, according to this example, the brightness in transmitted light mode improves by forming the light transmission hole AP in transflective and reflective film T/R.

Moreover, dispersion in the case of forming transflective and reflective film T/R by FOTORISO

etching can be minimized by having made the light transmission hole AP into the round hole configuration, and equalization of the opening area of the light transmission hole AP concerned is easy.

[0066] Furthermore, contrast can be improved by separating the light of the pixel field which prevents the optical leakage of back light light when the back light installed in the tooth back of a liquid crystal display component is turned on, and adjoins because formed Slit SLT in transfective and reflective film T/R of a part between electrodes ITO1 (the gap of an adjoining pixel field: slit) and while each pixel electrode is constituted formed the light-shielding film BM in this part.

[0067] Drawing 4 is a mimetic diagram explaining the configuration of the 4th example of the liquid crystal display component by this invention, and drawing 4 (a) shows the important section top view of the 1st transparence substrate with which drawing 4 (b) saw the important section cross section from [ of \*\* (a) ] arrow-head D-D. In addition, in drawing 4, the orientation film which regulates the direction of initial orientation of liquid crystal, a polarizing plate, a phase contrast plate, etc. omitted the graphic display.

[0068] This liquid crystal display component PNL is the same passive-matrix mold (STN-LCD) as the 1st - the 3rd example, and is pinching liquid crystal LC between the 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2.

[0069] The 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2 used the same glass plate as both the 1st - 3rd example. Transfective and reflective film T/R are formed in the inner surface of the 1st transparence substrate SUB 1, and two or more electrodes ITO1 of one [ which constitutes a pixel through the overcoat layer OC 1 ] are parallel, and are formed. One electrode ITO1 used ITO like the 1st - the 3rd example. The graphic display is omitted although the bottom orientation film with which the electrode ITO1 of one of these was covered, and orientation processing was performed by rubbing etc. is formed.

[0070] Moreover, it has the light filter CF of three colors (for example, R, G, B) in the location which countered the inner surface of the 2nd transparence substrate SUB 2 with one [ said ] electrode ITO1.

[0071] A light filter CF is covered, the overcoat layer OC 2 is formed, and it has the electrode ITO2 of another side in the upper layer (liquid crystal LC side). The electrode ITO2 of this another side is also formed with the same electrical conducting material as the electrode ITO1 of the method of up Norikazu.

[0072] A transparent electrode ITO1 is made to intersect, it is arranged, and a unit pixel is formed in an intersection for while the electrode ITO2 of another side was formed in the 1st transparence substrate SUB 1.

[0073] The field of the (Width X) x length (Y) which the light-shielding film (black matrix) BM which becomes the 1st transparence substrate SUB 1 from Width BM (BM (H)) and Length BM (BM (V)) was formed, and was surrounded in the above-mentioned width BM (BM (H)) and this length BM (BM (V)) is a pixel field (unit pixel) of one classification by color corresponding to one light filter.

[0074] Transfective and reflective film T/R are formed in the upper layer of the light-shielding film formed in the 1st transparence substrate SUB 1. Slit SLT was formed between electrodes ITO1, this slit SLT was filled up with the light-shielding film BM, and while this transfective and reflective film T/R become by formation of the same ingredient as the 1st - the 3rd example and adjoining has separated the pixel field.

[0075] And the light transmission hole AP is formed in the 1-pixel field of the (Width X) x length (Y) of this transfective and reflective film T/R. Although the number of the light transmission holes AP also makes this example four round holes to each pixel field, the number and a configuration are arbitrary so that it may mention later.

[0076] After a light-shielding film BM forms Slit SLT and the light transmission hole AP in transfective and reflective film T/R, it applies the protection-from-light ingredient which mixed the photosensitive resist, and can form it using the so-called photolithography technique which is made to harden the above-mentioned protection-from-light ingredient of a slit SLT part, and it leaves by giving tooth-back exposure from the 1st transparence substrate SUB 1 side.

[0077] At this time, a light transmission hole AP part is covered with a proper mask, or a light transmission hole AP part is covered with a proper mask at the time of spreading of a protection-from-light ingredient, a protection-from-light ingredient is not applied to the light transmission hole AP part concerned, and it makes and places.

[0078] In addition, the liquid crystal ingredient which constitutes the liquid crystal LC pinched between the 1st and 2nd transparence substrate SUB1 and SUB2 is STN (super twisted nematic) liquid crystal.

[0079] The light filter formed in the 2nd transparence substrate SUB 2 was formed according to the photolithography process which used the pigment-content powder type resist. However, it can form like the 1st example by the thing using the approach and ink jet which use a color for a stain and color it, the method of sticking the color sheet which printed three colors beforehand, and other known approaches.

[0080] The overcoat layers OC1 and OC2 aim at construction material protection of the liquid crystal ingredient which constitutes transfective and reflective film T/R, a light-shielding film BM, a light filter CF, and liquid crystal LC, reservation of the uniform liquid crystal orientation by surface flattening, etc. As an ingredient of this overcoat layer OC 1 (OC2), heat-curing mold acrylic resin, urethane resin, polyglycidylmethacrylate system resin, silica system inorganic material, etc. can be used.

[0081] As mentioned above, according to this example, the brightness in transmitted light mode improves by forming the light transmission hole AP in transfective and reflective film T/R. Moreover, dispersion in the case of forming transfective and reflective film T/R by FOTORISO etching can be minimized by having made the light transmission hole AP into the round hole configuration, and equalization of the opening area of the light transmission hole AP concerned is easy.

[0082] Furthermore, when the back light installed in the tooth back of a liquid crystal display component is turned on, the optical leakage of back light light is prevented, and if the light of an adjoining pixel field is separated, contrast can be improved, because formed Slit SLT in transfective and reflective film T/R of a part between electrodes ITO1 (the gap of an adjoining pixel field: slit) and while each pixel electrode is constituted filled up this part with the light-shielding film BM.

[0083] Drawing 5 is other configurations of the light transmission hole formed in transfective and the reflective film of the liquid crystal display component by this invention, and the explanatory view of the example of arrangement, and transfective and the reflective film are shown as a part (XxY) for a unit pixel.

[0084] Although the configuration of the light transmission hole AP formed in transfective and the reflective film was made into the round hole from a viewpoint of process tolerance in said each example, this invention is not restricted to this. This invention is setting to one of the descriptions the point of carrying out incidence of a part of light from the source of the illumination light installed in the tooth back of the 1st transparence substrate SUB 1 to liquid crystal through a pixel field.

[0085] Therefore, the configuration of the light transmission hole AP theoretically formed in transfective and the reflective film is not asked. This light transmission hole AP can be formed by known precision processing techniques, such as not only photolithography technique but laser beam machining.

[0086] (a) of drawing 5 makes the thing and \*\* (b) which made the light transmission hole AP elliptical the shape of a square. Moreover, \*\* (c) carries out the non-linear array (drawing staggered arrangement) of the round hole from which magnitude is the same as or differs in a pixel field. And \*\* (d) arranges the light transmission hole AP of a slit configuration.

[0087] The above-mentioned configuration and above-mentioned array of the light transmission hole AP may be combined, and the proper number can be formed in a proper array with a proper configuration according to the electrode configuration and size of a liquid crystal display component.

[0088] According to each above example, the amount of reflected lights and the amount of transmitted lights in reflected light mode and transmitted light mode can be increased, it is bright

and the liquid crystal display component which improved contrast can be obtained.

[0089] Moreover, a light-shielding film BM can also be formed between the light filters of each color formed in the 2nd transparence substrate. It is possible to use the black resist called chromium, chromic oxide, or resin black as the light-shielding film BM.

[0090] Next, that concrete example of structure is explained about the liquid crystal display using the liquid crystal display component and this liquid crystal display component of this invention. However, this invention is not limited to what is explained below.

[0091] Drawing 6 is the typical sectional view of the liquid crystal display component of the transfective and the reflective mold which used the liquid crystal display component, and is equivalent to the 1st example of this invention explained by said drawing 1.

[0092] The laminating of 1st low order phase differential plate PD1a, 2nd low order phase differential plate PD1b, and the bottom polarizing plate POL 1 is carried out to the outside surface of the 1st transparence substrate SUB 1 in this order. 1st low order phase differential plate PD1a is  $\lambda/4$  so-called plate, and the delatand is 140nm (measurement wavelength = 550nm).

[0093] And 2nd low order phase differential plate PD1b is  $\lambda/2$  so-called plate, and the delatand is 270nm (measurement wavelength = 550nm).

[0094] On the other hand, the laminating of 2nd high order phase differential plate PD2b, 1st high order phase differential plate PD2a, and the top polarizing plate POL 2 is carried out to the front face of the 2nd transparence substrate SUB 2 in this order. 2nd high order phase differential plate PD2b and 1st high order phase differential plate PD2a are stuck by the adhesive layer AD which added the light diffusion agent.

[0095] In addition, the lamination gap of the 1st transparence substrate SUB 1 and the 2nd transparence substrate SUB 2, i.e., the cel gap of liquid crystal LC, is maintained with the spacers SP, such as a polymer bead. This spacer SP is good for the inner surface of the 1st transparence substrate SUB 1 or the 2nd transparence substrate SUB 2 also as the so-called spacer of the shape of a column formed fixed. Or when a cel gap can be maintained with other means, it can also consider as the structure which does not arrange this spacer SP.

[0096] Drawing 7 is a mimetic diagram explaining the optical-axis configuration of the liquid crystal display component shown in drawing 6. An arrow head shows the direction of the opticals axis (an optical absorption shaft (it is also only called an absorption shaft), a drawing shaft, orientation shaft, etc.) of each part material which constitutes a liquid crystal display component to each layer, and the include angle is shown by the circumference of an anti-clock.

[0097] The inside of drawing, and theta 1 It is the absorption shaft of the top polarizing plate POL 2, and datum-line X-X (equivalent to the longitudinal direction of a screen) is received. 125 degrees, Drawing shaft theta 2 of 2nd high order phase differential plate PD2b 108 degrees and drawing shaft theta 3 of 1st high order phase differential plate PD2a 72 degrees, Drawing shaft theta 4 of 1st low order phase differential plate PD1a 130 degrees and drawing shaft theta 5 of 2nd low order phase differential plate PD1b 12.5 degrees and absorption shaft theta 6 of the bottom polarizing plate POL 1 It is 30 degrees.

[0098] And orientation shaft theta 7 of the bottom orientation film ORI1 formed in the 1st bottom substrate of transparence Orientation shaft theta 8 of the orientation film ORI2 after forming in 35 degrees and a top substrate It is 35 degrees. Twist  $\theta_T$  of liquid crystal It is 240 degrees or more and may be 250 degrees here.

[0099] Drawing 8 is type section drawing explaining the example of a configuration of the Personal Digital Assistant with a touch panel constituted using the liquid crystal display component by this invention. This example of a configuration is equipped with the liquid crystal display component PNL of the above mentioned transfective and reflective mold, the source of the illumination light, and the so-called back light BL.

[0100] In an environment dark in a perimeter, it becomes irregular by the image which formed in the liquid crystal display component PNL the illumination light from the back light PNL which penetrates the liquid crystal display component PNL, and the back light BL which carried out the laminating to the tooth back of the liquid crystal display component PNL visualizes an image by carrying out outgoing radiation of this to the screen side of the liquid crystal display component

PNL. Moreover, in a bright environment, it operates as a liquid crystal display component of the reflective mold which made the illumination light the outdoor daylight of the perimeter which carries out incidence from a screen side.

[0101] By pressing with a nib etc. to the screen side of this liquid crystal display component PNL, the laminating of the so-called touch panel TP in which the hand entry force is possible is carried out, and it inputs information from the screen of the liquid crystal display component PNL.

[0102] Namely, this liquid crystal display has the lamp CFL installed in the tooth back of the liquid crystal display component PNL along one edge of the light guide plate GLB2 with a transparent \*\*\*\* rectangle, and a light guide plate GLB, and the back light BL which has the lamp reflective sheet RFL, and is considering it as the configuration which it is made to direct in the liquid crystal display component PNL direction on the way which makes a light guide plate GLB spread the light from this back light BL, and illuminates the liquid crystal display component PNL from a tooth back in the transparency display mode. Moreover, the dot printing DOT etc. is formed in the tooth back of a light guide plate GLB by printing etc., and uniform brightness is obtained throughout the liquid crystal display component PNL.

[0103] The reflecting plate RF which the pan of a light guide plate GLB is made to carry out total reflection of the light which carried out outgoing radiation to the tooth back to a tooth-back side from a light guide plate GLB, and is returned to the liquid crystal display component PNL side is installed.

[0104] The laminating of the back light BL is carried out to the liquid crystal display component PNL through quantity of light distribution amendment members, such as the optical diffusion film DDP or a prism plate (not shown).

[0105] In addition, it can replace with the lamp CFL of the source of the illumination light, and other light sources, such as light emitting diode, can also be used.

[0106] Drawing 9 is a perspective view explaining the example of a configuration of the personal digital assistant as an example of electronic equipment which mounted the liquid crystal display by this invention. This personal digital assistant (PDA) contains a host computer HOST and Dc-battery BAT, and consists of the body section MN which equipped the front face with Keyboard KB, and a display DP which mounted the inverter INV a liquid crystal display LCD and for back lights.

[0107] A portable telephone PTP can be connected now to the body section MN through an interconnection cable L2, and it can communicate between remote places.

[0108] It connects by the interface cable L1 between the liquid crystal display LCD of Display DP, and the host computer MN.

[0109] Moreover, Penholder PNH is formed in a part of display DP, and the input pen PN is contained here.

[0110] This liquid crystal display has enabled selection of the information which carried out press actuation of the front face of a touch panel with the informational input and the input pen PN which used Keyboard KB, traced, inputted information various by entry, or was displayed on the liquid crystal display component PNL, selection of a processing facility, and various other actuation.

[0111] In addition, this kind of the configuration or structure of a personal digital assistant (PDA) are not restricted to what was illustrated, and can consider what possesses various configurations, structure, and a function.

[0112] Moreover, a portable telephone PTP can perform legible data display in a color by using the liquid crystal display component of this invention for the liquid crystal display component LCD 2 used for the display of the portable telephone PTP of drawing 9.

[0113]

[Effect of the Invention] As explained above, according to this invention, a perimeter chooses reflected light mode in a bright environment, transmitted light mode is chosen in a dark environment, and the image display of good contrast is brightly obtained with any display mode of the above-mentioned transmitted light in the liquid crystal display component of the transfective and the reflective mold with which clear full color image display is obtained by

environmental brightness bright related always, and the reflected light, and the liquid crystal display component in which good color display is possible can be offered with any display mode.

[Translation done.]

## \* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

## DESCRIPTION OF DRAWINGS

## [Brief Description of the Drawings]

[Drawing 1] It is a mimetic diagram explaining the configuration of the 1st example of the liquid crystal display component by this invention.

[Drawing 2] It is a mimetic diagram explaining the configuration of the 2nd example of the liquid crystal display component by this invention.

[Drawing 3] It is a mimetic diagram explaining the configuration of the 3rd example of the liquid crystal display component by this invention.

[Drawing 4] It is a mimetic diagram explaining the configuration of the 4th example of the liquid crystal display component by this invention.

[Drawing 5] They are other configurations of the light transmission hole formed in transfective and the reflective film of the liquid crystal display component by this invention, and the explanatory view of the example of arrangement.

[Drawing 6] It is the typical sectional view of the liquid crystal display component of the transfective and the reflective mold using a liquid crystal display component.

[Drawing 7] It is a mimetic diagram explaining the optical-axis configuration of the liquid crystal display component shown in drawing 6 .

[Drawing 8] It is type section drawing explaining the example of a configuration of the Personal Digital Assistant with a touch panel constituted using the liquid crystal display component by this invention.

[Drawing 9] It is a perspective view explaining the example of a configuration of the personal digital assistant as an example of electronic equipment which mounted the liquid crystal display by this invention.

## [Description of Notations]

PNL Liquid crystal display component

SUB1 1st transperence substrate

SUB2 2nd transperence substrate

LC Liquid crystal

T/R Transfective and reflective film

AP Light transmission hole

SLT Slit

OC1, OC2 Overcoat layer

ITO1 One electrode

ITO2 Electrode of another side

ORI1 Bottom orientation film

PRI2 Top orientation film

CF Light filter

BM Light-shielding film (black matrix)

PD1a, PD1b Low order phase differential plate

PD2a, PD2b High order phase differential plate

POL1 Bottom polarizing plate

POL2 Top polarizing plate

SP Spacer.

[Translation done.]

## \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

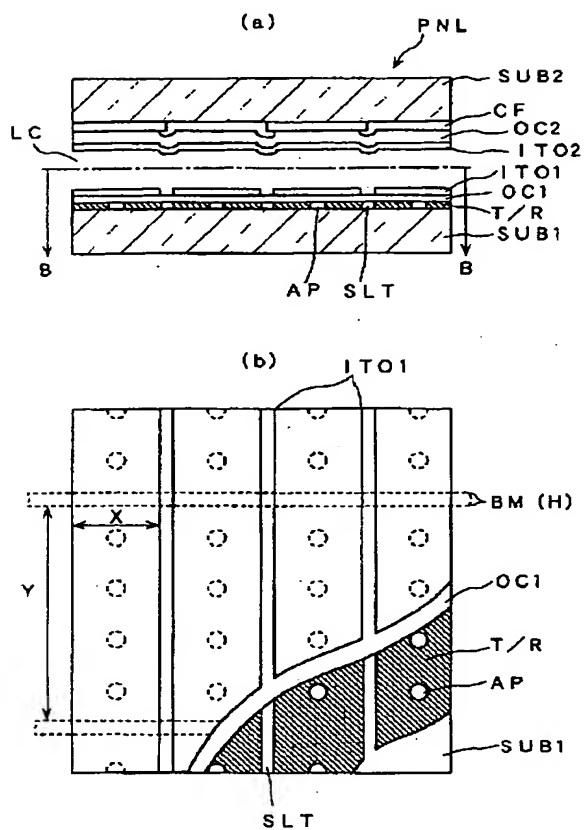
## DRAWINGS

[Drawing 1]

Figure 1 consists of two parts: (a) a cross-sectional view and (b) a plan view. Part (a) shows a layered structure with labels: PNL, SUB2, CF, OC2, ITO2, ITO1, OC1, T/R, and SUB1. A vertical line A-A is indicated. Part (b) shows a plan view of the ITO1 layer with a grid of circles. Labels include ITO1, BM (H), OC1, T/R, AP, and SUB1. Dimensions X and Y are indicated.

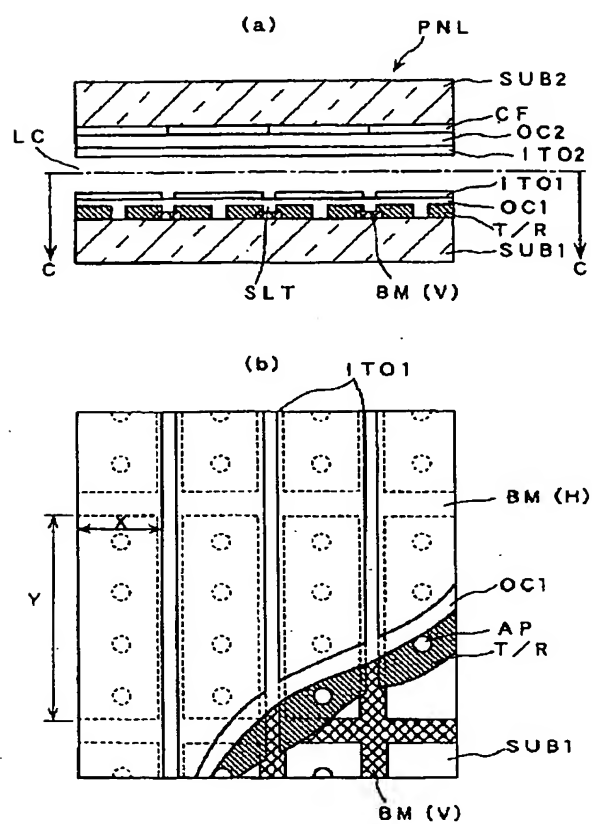
[Drawing 2]

図 2



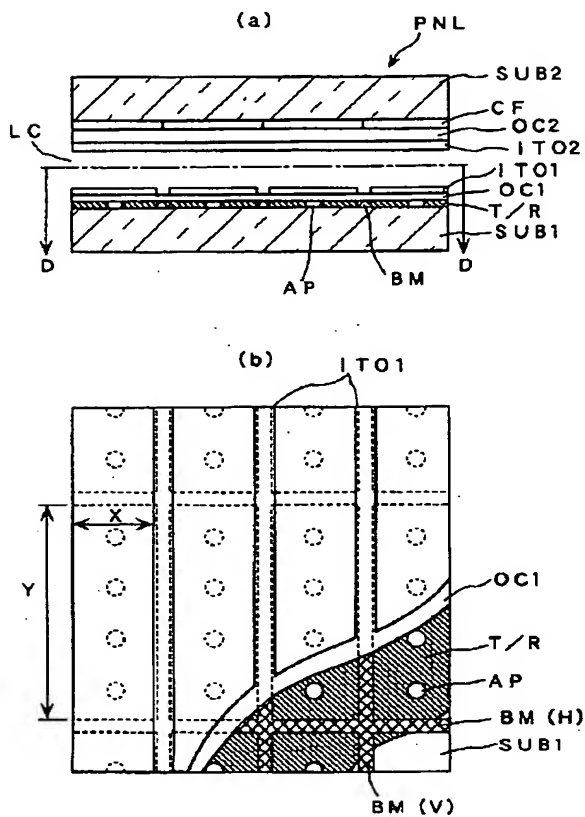
[Drawing 3]

图 3



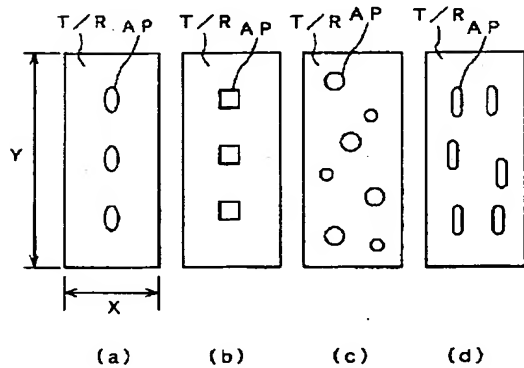
[Drawing 4]

図 4



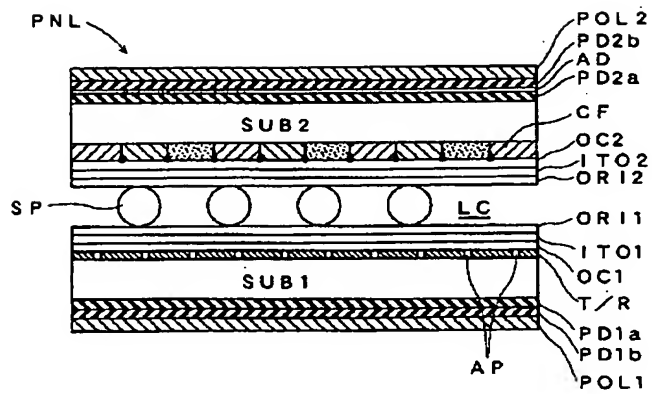
[Drawing 5]

図 5



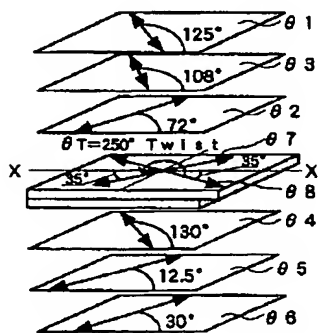
[Drawing 6]

図 6



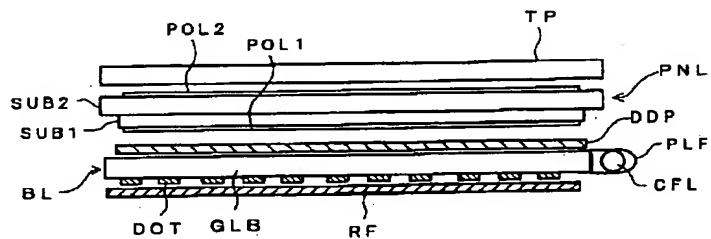
[Drawing 7]

図 7

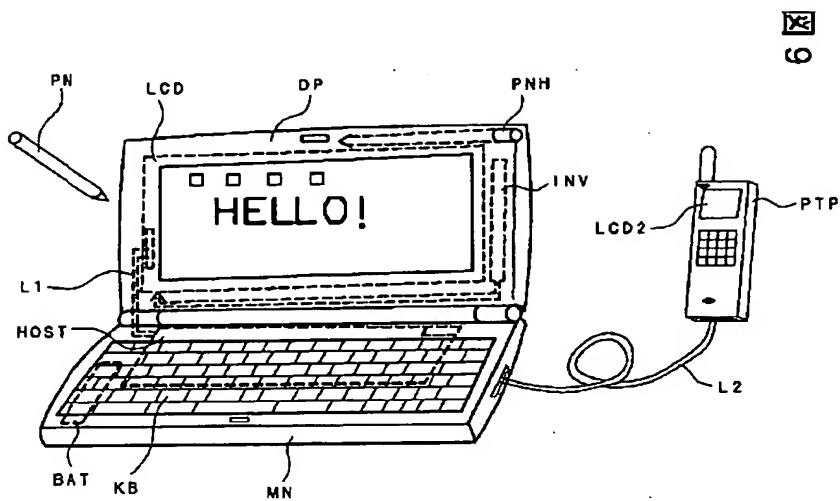


[Drawing 8]

図 8



[Drawing 9]



[Translation done.]